

Appln. No. 10/627,839  
Amdt. Dated May 4, 2005  
Reply to Office Action of March 21, 2005

**AMENDMENTS TO THE CLAIMS:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

1-2. (Canceled)

3. (Currently Amended) ~~The magnetoresistive head according to claim 1~~ A magnetoresistive head, comprising:

a spin-valve film as a magnetic sensor element for detecting magnetic signals while in contact with a magnetic recording medium, said spin-valve film having a structure in which an anti-ferromagnetic layer, a pinned layer in which the direction of magnetization is pinned in a predetermined direction by an exchange-coupling magnetic field at work between itself and said anti-ferromagnetic layer, a free layer in which the direction of magnetization changes in accordance with an external magnetic field, and a non-magnetic layer for magnetically isolating said pinned layer and said free layer are layered,

wherein said spin-valve film has a corrosion potential relative to a standard hydrogen electrode of +0.4, [V vs. SHE] or greater when immersed in a NaCl solution of a concentration of 0.1 mol/L,

wherein said non-magnetic layer comprises CuAu, and assuming wherein the composition ratio of Cu: Au is  $(100-a_1):a_1$  (where  $a_1$  represents atomic %), respectively, the composition range thereof is such that  $25 \leq a_1 < 100$ , said pinned layer and said free layer comprise one of NiFe and CoNiFe, and assuming wherein the composition ratio of Co: Ni: Fe is  $b_1:c_1:d_1$  (where  $b_1$ ,  $c_1$  and  $d_1$  represent atomic %), respectively, the composition ranges

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thereof are such that  $0 \leq b_1 \leq 75$ ,  $15 \leq c_1 \leq 95$  and  $5 \leq d_1 \leq 40$  (where  $b_1 + c_1 + d_1 = 100$  atomic %), and

said magnetoresistive head detects magnetic signals while in contact with a tape-formed magnetic recording medium.

4. (Currently Amended) ~~The magnetoresistive head according to claim 2,~~ A magnetoresistive head, comprising:

a spin-valve film as a magnetic sensor element for detecting magnetic signals while in contact with a magnetic recording medium, said spin-valve film having a structure in which an anti-ferromagnetic layer, a pinned layer in which the direction of magnetization is pinned in a predetermined direction by an exchange-coupling magnetic field at work between itself and said anti-ferromagnetic layer, a free layer in which the direction of magnetization changes in accordance with an external magnetic field, and a non-magnetic layer for magnetically isolating said pinned layer and said free layer are layered,

wherein in said spin-valve film, each of said anti-ferromagnetic layer, said pinned layer, said free layer and said non-magnetic layer has a corrosion potential relative to a standard hydrogen electrode of +0.4 [V vs. SHE] or greater when immersed in a NaCl solution of a concentration of 0.1 mol/L,

wherein said non-magnetic layer comprises CuAu, and assuming wherein the composition ratio of Cu: Au is  $(100 - a_1):a_1$  (where  $a_1$  represents atomic %), respectively, the composition range thereof is such that  $25 \leq a_1 < 100$ ,

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said pinned layer and said free layer comprise one of NiFe and CoNiFe, and ~~assuming~~  
wherein the composition ratio of Co:Ni:Fe is  $b_1:c_1:d_1$  (where  $b_1$ ,  $c_1$  and  $d_1$  represent atomic  
%), respectively, the composition ranges thereof are such that  $0 \leq b_1 \leq 75$ ,  $15 \leq c_1 \leq 95$  and  $5$   
 $\leq d_1 \leq 40$  (where  $b_1 + c_1 + d_1 = 100$  atomic %), and

said magnetoresistive head detects magnetic signals while in contact with a tape-  
formed magnetic recording medium.

5-6. (Canceled)

7. (Currently Amended) ~~The magnetoresistive head according to claim 1, A magnetoresistive~~  
head, comprising:

a spin-valve film as a magnetic sensor element for detecting magnetic signals while in  
contact with a magnetic recording medium, said spin-valve film having a structure in which  
an anti-ferromagnetic layer, a pinned layer in which the direction of magnetization is pinned  
in a predetermined direction by an exchange-coupling magnetic field at work between itself  
and said anti-ferromagnetic layer, a free layer in which the direction of magnetization changes  
in accordance with an external magnetic field, and a non-magnetic layer for magnetically  
isolating said pinned layer and said free layer are layered,

wherein said spin-valve film has a corrosion potential relative to a standard hydrogen  
electrode of +0.4 [V vs. SHE] or greater when immersed in a NaCl solution of a  
concentration of 0.1 mol/L,

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wherein said non-magnetic layer comprises CuPd, and assuming wherein the composition ratio of Cu:Pd is  $(100-a_3):a_3$  (where  $a_3$  represents atomic %), respectively, the composition range thereof is such that  $5 a_3 \leq 25$ ,

said pinned layer and said free layer comprise one of NiFe and CoNiFe, and assuming wherein the composition ratio of Co:Ni:Fe is  $b_3:c_3:d_3$  (where  $b_3$ ,  $c_3$  and  $d_3$  represent atomic %), respectively, the composition ranges thereof are such that  $0 \leq b_3 \leq 75$ ,  $15 \leq c_3 \leq 95$  and  $5 \leq d_3 \leq 40$  (where  $b_3 + c_3 + d_3 = 100$  atomic %), and

said magnetoresistive head detects magnetic signals while in contact with a tape-formed magnetic recording medium.

8. (Currently Amended) ~~The magnetoresistive head according to claim 2, A magnetoresistive head, comprising:~~

a spin-valve film as a magnetic sensor element for detecting magnetic signals while in contact with a magnetic recording medium, said spin-valve film having a structure in which an anti-ferromagnetic layer, a pinned layer in which the direction of magnetization is pinned in a predetermined direction by an exchange-coupling magnetic field at work between itself and said anti-ferromagnetic layer, a free layer in which the direction of magnetization changes in accordance with an external magnetic field, and a non-magnetic layer for magnetically isolating said pinned layer and said free layer are layered, wherein

in said spin-valve film, each of said anti-ferromagnetic layer, said pinned layer, said free layer and said non-magnetic layer has a corrosion potential relative to a standard

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hydrogen electrode of +0.4. [V vs. SHE] or greater when immersed in a NaCl solution of a concentration of 0.1 mol/L:

wherein said non-magnetic layer comprises CuPd, and ~~assuming~~ wherein the composition ratio of Cu:Pd is  $(100 - a_3):a_3$  (where  $a_3$  represents atomic %), respectively, the composition range thereof is such that  $5 \leq a_3 \leq 25$ ,

said pinned layer and said free layer comprise one of NiFe and CoNiFe, and ~~assuming~~ wherein the composition ratio of Co:Ni:Fe is  $b_3:c_3:d_3$  (where  $b_3$ ,  $c_3$  and  $d_3$  represent atomic %), respectively, the composition ranges thereof are such that  $0 \leq b_3 \leq 75$ ,  $15 \leq c_3 \leq 95$  and  $5 \leq d_3 \leq 40$  (where  $b_3+c_3+d_3=100$  atomic %), and

said magnetoresistive head detects magnetic signals while in contact with a tape-formed magnetic recording medium.

9. (Currently Amended) ~~The magnetoresistive head according to claim 1;~~ A magnetoresistive head, comprising:

a spin-valve film as a magnetic sensor element for detecting magnetic signals while in contact with a magnetic recording medium, said spin-valve film having a structure in which an anti-ferromagnetic layer, a pinned layer in which the direction of magnetization is pinned in a predetermined direction by an exchange-coupling magnetic field at work between itself and said anti-ferromagnetic layer, a free layer in which the direction of magnetization changes in accordance with an external magnetic field, and a non-magnetic layer for magnetically isolating said pinned layer and said free layer are layered.

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wherein said spin-valve film has a corrosion potential relative to a standard hydrogen electrode of +0.4 [V vs. SHE] or greater when immersed in a NaCl solution of a concentration of 0.1 mol/L.

wherein said non-magnetic layer comprises CuPt, and assuming wherein the composition ratio of Cu:Pt is  $(100 - a_4):a_4$  (where  $a_4$  represents atomic %), respectively, the composition range thereof is such that  $5 \leq a_4 \leq 20$ ,

said pinned layer and said free layer comprise one of NiFe and CoNiFe, and assuming wherein the composition ratio of Co:Ni:Fe is  $b_4:c_4:d_4$  (where  $b_4$ ,  $c_4$  and  $d_4$  represent atomic %), respectively, the composition ranges thereof are such that  $0 \leq b_4 \leq 75$ ,  $15 \leq c_4 \leq 95$  and  $5 \leq d_4 \leq 40$  (where  $b_4 + c_4 + d_4 = 100$  atomic %), and

said magnetoresistive head detects magnetic signals while in contact with a tape-formed magnetic recording medium.

10. (Currently Amended) ~~The magnetoresistive head according to claim 2, A~~  
magnetoresistive head comprising:

a spin-valve film as a magnetic sensor element for detecting magnetic signals while in contact with a magnetic recording medium, said spin-valve film having a structure in which an anti-ferromagnetic layer, a pinned layer in which the direction of magnetization is pinned in a predetermined direction by an exchange-coupling magnetic field at work between itself and said anti-ferromagnetic layer, a free layer in which the direction of magnetization changes in accordance with an external magnetic field, and a non-magnetic layer for magnetically

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isolating said pinned layer and said free layer are layered.

wherein in said spin-valve film, each of said anti-ferromagnetic layer, said pinned layer, said free layer and said non-magnetic layer has a corrosion potential relative to a standard hydrogen electrode of +0.4. [V vs. SHE] or greater when immersed in a NaCl solution of a concentration of 0.1 mol/L.

wherein said non-magnetic layer comprises CuPt, and assuming wherein the composition ratio of Cu:Pt is  $(100 - a_4):a_4$  (where  $a_4$  represents atomic %), respectively, the composition range thereof is such that  $5 \leq a_4 \leq 20$ ,

said pinned layer and said free layer comprise one of NiFe and CoNiFe, and assuming wherein the composition ratio of Co:Ni:Fe is  $b_4:c_4:d_4$  (where  $b_4$ ,  $c_4$  and  $d_4$  represent atomic %), respectively, the composition ranges thereof are such that  $0 \leq b_4 \leq 75$ ,  $15 \leq c_4 \leq 95$  and  $5 \leq d_4 \leq 40$  (where  $b_4 + c_4 + d_4 = 100$  atomic %), and

said magnetoresistive head detects magnetic signals while in contact with a tape-formed magnetic recording medium.

11. (Currently Amended) ~~The magnetoresistive head according to claim 1, A~~  
magnetoresistive head, comprising:

a spin-valve film as a magnetic sensor element for detecting magnetic signals while in contact with a magnetic recording medium, said spin-valve film having a structure in which an anti-ferromagnetic layer, a pinned layer in which the direction of magnetization is pinned in a predetermined direction by an exchange-coupling magnetic field at work between itself

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and said anti-ferromagnetic layer, a free layer in which the direction of magnetization changes in accordance with an external magnetic field, and a non-magnetic layer for magnetically isolating said pinned layer and said free layer are layered

wherein said spin-valve film has a corrosion potential relative to a standard hydrogen electrode of +0.4 [V vs. SHE] or greater when immersed in a NaCl solution of a concentration of 0.1 mol/L,

wherein said non-magnetic layer comprises CuRu, and assuming wherein the composition ratio of Cu:Ru is  $(100 - a_3):a_3$  (where  $a_3$  represents atomic %), respectively, the composition range thereof is such that  $3 \leq a_3 \leq 15$ ,

said pinned layer and said free layer comprise one of NiFe and CoNiFe, and assuming wherein the composition ratio of Co:Ni:Fe is  $b_3:c_3:d_3$  (where  $b_3$ ,  $c_3$  and  $d_3$  represent atomic %), respectively, the composition ranges thereof are such that  $0 \leq b_3 \leq 75$ ,  $15 \leq c_3 \leq 95$  and  $5 \leq d_3 \leq 40$  (where  $b_3 + c_3 + d_3 = 100$  atomic %), and

said magnetoresistive head detects magnetic signals while in contact with a tape-formed magnetic recording medium.

12. (Currently Amended ) ~~The magnetoresistive head according to claim 2, A~~  
magnetoresistive head, comprising:

a spin-valve film as a magnetic sensor element for detecting magnetic signals while in contact with a magnetic recording medium, said spin-valve film having a structure in which an anti-ferromagnetic layer, a pinned layer in which the direction of magnetization is pinned



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in a predetermined direction by an exchange-coupling magnetic field at work between itself and said anti-ferromagnetic layer, a free layer in which the direction of magnetization changes in accordance with an external magnetic field, and a non-magnetic layer for magnetically isolating said pinned layer and said free layer are layered,

wherein in said spin-valve film, each of said anti-ferromagnetic layer, said pinned layer, said free layer and said non-magnetic layer has a corrosion potential relative to a standard hydrogen electrode of  $\geq 0.4$  [V vs. SHE] or greater when immersed in a NaCl solution of a concentration of 0.1 mol/L,

wherein said non-magnetic layer comprises CuRu, and assuming wherein the composition ratio of Cu:Ru is  $(100 - a_3):a_3$  (where  $a_3$  represents atomic %), respectively, the composition range thereof is such that  $3 \leq a_3 \leq 15$ ,

said pinned layer and said free layer comprise one of NiFe and CoNiFe, and assuming wherein the composition ratio of Co:Ni:Fe is  $b_3:c_3:d_3$  (where  $b_3$ ,  $c_3$  and  $d_3$  represent atomic %), respectively, the composition ranges thereof are such that  $0 \leq b_3 \leq 75$ ,  $15 \leq c_3 \leq 95$  and  $5 \leq d_3 \leq 40$  (where  $b_3+c_3+d_3=100$  atomic %), and

said magnetoresistive head detects magnetic signals while in contact with a tape-formed magnetic recording medium.

13. (Currently Amended) ~~The magnetoresistive head according to claim 1, A~~  
magnetoresistive head, comprising:

a spin-valve film as a magnetic sensor element for detecting magnetic signals while in

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contact with a magnetic recording medium, said spin-valve film having a structure in which an anti-ferromagnetic layer, a pinned layer in which the direction of magnetization is pinned in a predetermined direction by an exchange-coupling magnetic field at work between itself and said anti-ferromagnetic layer, a free layer in which the direction of magnetization changes in accordance with an external magnetic field, and a non-magnetic layer for magnetically isolating said pinned layer and said free layer are layered,

wherein said spin-valve film has a corrosion potential relative to a standard hydrogen electrode of +0.4 [V vs. SHE] or greater when immersed in a NaCl solution of a concentration of 0.1 mol/L,

wherein said non-magnetic layer comprises CuNi, and assuming wherein the composition ratio of Cu:Ni is  $(100 - a_6):a_6$  (where  $a_6$  represents atomic %), respectively, the composition range thereof is such that  $25 \leq a_6 \leq 50$ ,

said pinned layer and said free layer comprise one of NiFe and CoNiFe, and assuming wherein the composition ratio of Co:Ni:Fe is  $b_6:c_6:d_6$  (where  $b_6$ ,  $c_6$  and  $d_6$  represent atomic %), respectively, the composition ranges thereof are such that  $0 \leq b_6 \leq 75$ ,  $15 \leq c_6 \leq 95$  and  $5 \leq d_6 \leq 40$  (where  $b_6 + c_6 + d_6 = 100$  atomic %), and

said magnetoresistive head detects magnetic signals while in contact with a tape-formed magnetic recording medium.

14. (Currently Amended) ~~The magnetoresistive head according to claim 2, A~~  
magnetoresistive head, comprising:

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a spin-valve film as a magnetic sensor element for detecting magnetic signals while in contact with a magnetic recording medium, said spin-valve film having a structure in which an anti-ferromagnetic layer, a pinned layer in which the direction of magnetization is pinned in a predetermined direction by an exchange-coupling magnetic field at work between itself and said anti-ferromagnetic layer, a free layer in which the direction of magnetization changes in accordance with an external magnetic field, and a non-magnetic layer for magnetically isolating said pinned layer and said free layer are layered,

wherein in said spin-valve film, each of said anti-ferromagnetic layer, said pinned layer, said free layer and said non-magnetic layer has a corrosion potential relative to a standard hydrogen electrode of +0.4 [V vs. SHE] or greater when immersed in a NaCl solution of a concentration of 0.1 mol/L,

wherein said non-magnetic layer comprises CuNi, and assuming wherein the composition ratio of Cu:Ni is  $(100 - a_6):a_6$  (where  $a_6$  represents atomic %), respectively, the composition range thereof is such that  $25 \leq a_6 \leq 50$ ,

said pinned layer and said free layer comprise one of NiFe and CoNiFe, and assuming wherein the composition ratio of Co:Ni:Fe is  $b_6:c_6:d_6$  (where  $b_6$ ,  $c_6$  and  $d_6$  represent atomic %), respectively, the composition ranges thereof are such that  $0 \leq b_6 \leq 75$ ,  $15 \leq c_6 \leq 95$  and  $5 \leq d_6 \leq 40$  (where  $b_6+c_6+d_6=100$  atomic %), and

said magnetoresistive head detects magnetic signals while in contact with a tape-formed magnetic recording medium.

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15. (Currently Amended) ~~The magnetoresistive head according to claim 1, A~~  
magnetoresistive head, comprising:

a spin-valve film as a magnetic sensor element for detecting magnetic signals while in contact with a magnetic recording medium, said spin-valve film having a structure in which an anti-ferromagnetic layer, a pinned layer in which the direction of magnetization is pinned in a predetermined direction by an exchange-coupling magnetic field at work between itself and said anti-ferromagnetic layer, a free layer in which the direction of magnetization changes in accordance with an external magnetic field, and a non-magnetic layer for magnetically isolating said pinned layer and said free layer are layered,

wherein said spin-valve film has a corrosion potential relative to a standard hydrogen electrode of +0.4, [V vs. SHE] or greater when immersed in a NaCl solution of a concentration of 0.1 mol/L,

wherein said non-magnetic layer comprises CuRh, and assuming wherein the composition ratio of Cu:Rh is  $(100 - a_7):a_7$  (where  $a_7$  represents atomic %), respectively, the composition range thereof is such that  $7 \leq a_7 \leq 20$ ,

said pinned layer and said free layer comprise one of NiFe and CoNiFe, and assuming wherein the composition ratio of Co:Ni:Fe is  $b_7:c_7:d_7$  (where  $b_7$ ,  $c_7$  and  $d_7$  represent atomic %), respectively, the composition ranges thereof are such that  $0 \leq b_7 \leq 75$ ,  $15 \leq c_7 \leq 95$  and  $5 \leq d_7 \leq 40$  (where  $b_7+c_7+d_7=100$  atomic %), and

said magnetoresistive head detects magnetic signals while in contact with a tape-formed magnetic recording medium.

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16. (Currently Amended) ~~The magnetoresistive head according to claim 2, A~~  
magnetoresistive head, comprising:

a spin-valve film as a magnetic sensor element for detecting magnetic signals while in contact with a magnetic recording medium, said spin-valve film having a structure in which an anti-ferromagnetic layer, a pinned layer in which the direction of magnetization is pinned in a predetermined direction by an exchange-coupling magnetic field at work between itself and said anti-ferromagnetic layer, a free layer in which the direction of magnetization changes in accordance with an external magnetic field, and a non-magnetic layer for magnetically isolating said pinned layer and said free layer are layered,

wherein in said spin-valve film, each of said anti-ferromagnetic layer, said pinned layer, said free layer and said non-magnetic layer has a corrosion potential relative to a standard hydrogen electrode of +0.4 [V vs. SHE] or greater when immersed in a NaCl solution of a concentration of 0.1 mol/l,

wherein said non-magnetic layer comprises CuRh, and assuming wherein the composition ratio of Cu:Rh is  $(100 - a_7):a_7$  (where  $a_7$  represents atomic %), respectively, the composition range thereof is such that  $7 \leq a_7 \leq 20$ ,

said pinned layer and said free layer comprise one of NiFe and CoNiFe, and assuming wherein the composition ratio of Co:Ni:Fe is  $b_7:c_7:d_7$  (where  $b_7$ ,  $c_7$  and  $d_7$  represent atomic %), respectively, the composition ranges thereof are such that  $0 \leq b_7 \leq 75$ ,  $15 \leq c_7 \leq 95$  and  $5 \leq d_7 \leq 40$  (where  $b_7+c_7+d_7=100$  atomic %), and

said magnetoresistive head detects magnetic signals while in contact with a tape-

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formed magnetic recording medium.

17-20. (Canceled)

21. (Original) The magnetoresistive head according to claim 3, wherein said magnetic sensor element is mounted on a rotary drum and detects magnetic signals while contacting said tape-formed magnetic recording medium by a helical scan method.

22. (Original) The magnetoresistive head according to claim 4, wherein said magnetic sensor element is mounted on a rotary drum and detects magnetic signals while contacting said tape-formed magnetic recording medium by a helical scan method.

23-24. (Canceled)

25. (Original) The magnetoresistive head according to claim 7, wherein said magnetic sensor element is mounted on a rotary drum and detects magnetic signals while contacting said tape-formed magnetic recording medium by a helical scan method.

26. (Original) The magnetoresistive head according to claim 8, wherein said magnetic sensor element is mounted on a rotary drum and detects magnetic signals while contacting said tape-formed magnetic recording medium by a helical scan method.

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27. (Original) The magnetoresistive head according to claim 9, wherein said magnetic sensor element is mounted on a rotary drum and detects magnetic signals while contacting said tape-formed magnetic recording medium by a helical scan method.
28. (Original) The magnetoresistive head according to claim 10, wherein said magnetic sensor element is mounted on a rotary drum and detects magnetic signals while contacting said tape-formed magnetic recording medium by a helical scan method.
29. (Original) The magnetoresistive head according to claim 11, wherein said magnetic sensor element is mounted on a rotary drum and detects magnetic signals while contacting said tape-formed magnetic recording medium by a helical scan method.
30. (Original) The magnetoresistive head according to claim 12, wherein said magnetic sensor element is mounted on a rotary drum and detects magnetic signals while contacting said tape-formed magnetic recording medium by a helical scan method.
31. (Original) The magnetoresistive head according to claim 13, wherein said magnetic sensor element is mounted on a rotary drum and detects magnetic signals while contacting said tape-formed magnetic recording medium by a helical scan method.
32. (Original) The magnetoresistive head according to claim 14, wherein said magnetic sensor element is mounted on a rotary drum and detects magnetic signals while contacting

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said tape-formed magnetic recording medium by a helical scan method.

33. (Original) The magnetoresistive head according to claim 15, wherein said magnetic sensor element is mounted on a rotary drum and detects magnetic signals while contacting said tape-formed magnetic recording medium by a helical scan method.

34. (Original) The magnetoresistive head according to claim 16, wherein said magnetic sensor element is mounted on a rotary drum and detects magnetic signals while contacting said tape-formed magnetic recording medium by a helical scan method.

35-36. (Canceled)